FIELD OBSERVATIONS OF THE "HILLTOPPING" PHENOMENON IN NORTH-WEST AFRICA – AND AN INTRODUCTION TO "RAVINING" (LEP.: RHOPALOCERA)

W.J. TENNENT

1 Middlewood Close, Fylingthorpe, Whitby, North Yorkshire YO22 4UD.

Introduction

THE PHENOMENON known as "hilltopping", in which butterflies congregate, often in large numbers, on the summits of hills, mountains and ridges, is well-known to anyone who has collected butterflies in the tropics, south Europe, or in the Middle East and other desert localities. The phenomenon is not confined to the Lepidoptera and has been noted in other insects, including Diptera, Hymenoptera and, less frequently, Coleoptera, Odonata and Orthoptera.

In the case of butterflies, much has been written on the subject, notably by Shields (1967), who carried out comprehensive studies in California and defined hilltopping as "a phenomenon in which males and virgin or multiple-mating females instinctively seek a topographic summit to mate" (Shields, 1967:150). The behaviour undoubtedly serves to bring males and females together to ensure fertilisation and is of paramount value in species which have a low population density.

Other interpretations have been suggested, including that winds and updrafts, combined with aimless, non-directional flight, cause butterflies to congregate "against their will" on the tops of hills. Shields (1967, pp.154-156) discarded this explanation for good reasons and the author can confirm not only that hilltopping takes place on days when there is little or no air movement, but that many species fly into even a moderate or strong breeze and some species, notably *Papilio machaon* Linnaeus, 1758 and *P. saharae* Oberthür, 1879, may sometimes deliberately seek the windward side of a ridge on windy days. The reason for so doing is not clear; perhaps it is easier for a resting butterfly to escape potential predators in windy conditions; certainly when butterflies are disturbed under such conditions, they are whisked away by the wind much more quickly than they could ever escape by flying. However, the best explanation for the phenomenon, now generally accepted as being the most likely purpose served by hilltopping, is that of finding a mate.

Not all butterfly species hilltop; in the western Palaearctic most Papilionidae, many Pieridae and to a lesser extent, Lycaenidae and Satyridae do so. Species from other families do so occasionally. Some species observed on hill-tops cannot be regarded as truly hilltopping since they are transient, flying "up and over", rather than remaining at the summit.

This paper records the author's observations of an assemblage of butterflies on a ridge in the Moroccan High Atlas mountains in June 1994, remarkable in terms both of total numbers and diversity of species. General

comments on the phenomenon in north-west Africa, based on the author's field experience, are incorporated where appropriate. Additional observations of a different phenomenon, which may be described as ravining and which may serve the same purpose as hilltopping for some species in semi-desert regions, are included.

Observations on Adrar-n-Guinnous

At 2788 metres, Adrar-n-Guinnous is the highest peak above the Tizi-n-Test, a well-known pass which crosses the western end of the High Atlas, from north to south; it lies to the east of the road and is reached with difficulty by either scrambling up the steep western side, or by walking along the ridge from the auberge to the south-west. It is part of a series of ridges and summits running west-south-west/east-north-east; the summit consists of a narrow ridge some 250 metres in length, slightly higher at the north-east end (the actual summit). The ground falls away sharply on the western side and there is a very steep drop of several hundred metres to the east. The upper slopes have bare, rocky patches, but also support a variety of flowering shrubs and other sparse vegetation. The area is largely undisturbed, except by the inevitable mixed herds of goats and sheep which, at present, do not seem to be sufficiently large or frequent enough to cause serious or lasting damage.

On 11th June 1994, the author climbed to the summit in conditions which included bright sunshine and, *very* unusual for this area and altitude, no wind. In a period of some four hours, many hundreds of individuals of 32 species, representing 26% of the total butterfly fauna of Morocco, were observed on the summit ridge. Some species were present in small numbers; others were in very large numbers and in the case of some species, in particular *Pontia daplidice* Linnaeus, 1758, *Nordmannia esculi* Hübner, 1804, *Berberia lambessanus* Staudinger, 1901 and *Coenonympha vaucheri* Blachier, 1905, it was difficult to see what advantage was gained by the behaviour.

Annotated list of species seen at the summit

Hesperiidae:

Thymelicus sp. (probably *sylvestris,* Poda, 1761)

A solitary male seen which could not be said to be hilltopping since it was feeding on the flowers of a spiny *Astragalus* sp. (Leguminosae); two or three *sylvestris* were seen between 2100 metres and 2300 metres lower on the mountain. With the exception of *Hesperia comma* Linnaeus, 1758, Hesperiids are only rarely observed hilltopping in north-west Africa.

Papilionidae:

Papilio machaon Linnaeus, 1758

Four males seen flying swiftly around the summit; the species is a frequent hilltopper throughout its range; none were seen lower on the mountain.

Pieridae:

Pieris brassicae Linnaeus, 1758
Three males on summit; a few individuals of both sexes seen on slopes and in a gully between 2000 metres and 2100 metres. Not a species which routinely hilltops, single specimens of this strongly migratory butterfly are often found wandering aimlessly in apparently unsuitable areas, including barren places.

Pieris rapae Linnaeus. 1758
Approximately ten males and at least two females, although total numbers were difficult to establish in the chaos. The two females were observed for some time; they remained on the summit ridge but were not paid any attention by the males present. There would seem to be little advantage in hilltopping for such a common and widespread species which presumably would have no difficulty in finding a mate lower down, without resorting to the (presumed) inconvenience of flying to a hilltop.

Pontia daplidice Linnaeus, 1758
The most numerous species present, several hundred were dashing around the summit ridge, making accurate counting impossible. Most were males, although there was a small number of females, possibly as many as 20; no courting or mating behaviour was observed. Some 200 metres to 400 metres lower down, the species was abundant, with males only slightly more numerous than females; most females were being pursued by at least one male and many pairs were seen *in copula*. The species was common almost everywhere else on the slopes.

It certainly was not necessary in this case for "males and females to find a topograhic summit to mate" and the only apparent practical advantage for the species appeared to be that, with so many males otherwise engaged on the summit ridge, females lower on the mountain were able to go about their business of egg laying relatively undisturbed.

Euchloe ausonia Hübner, 1820
Only three males were seen, although the presence of others may have been masked by the enormous numbers of other white Pierids. This was a late date for the species here and no other individuals were seen elsewhere on the slopes.

Elphinstonia charlonia Donzel, 1842
A single male of this notorious hilltopper was observed. At best the species is sporadic and uncommon at this level in the High Atlas and is unlikely to have found a mate, even though it was generally more widespread than usual in 1994 due to a damp spring which ended three years of drought. The species is also found well into northern desert regions in Morocco, Algeria and Tunisia, where almost every ridge and hill-top in the spring harbours a few *charlonia* males.

Colias croceus Geoffroy in Fourcroy, 1785
Several observed with males and females in approximately equal numbers; it was common on the lower slopes. The volume of butterflies made observations of individuals somewhat difficult and it may be that the species was not truly hilltopping; Shields (1967:161) noted that *Colias* species apparently never hilltop in North America.

Gonepteryx cleopatra Linnaeus, 1767
Two males seen. Like *P. brassicae* and *Gonepteryx rhamni* Linnaeus, 1758, *cleopatra* is often seen singly some distance from an apparently suitable biotope although the author has never found it defending a territory on a hilltop; its presence on high points is probably coincidental.

Lycaenidae:

Nordmannia esculi Hübner, 1804
Approximately 15-20 males on the summit resting on bare rocks and occasionally feeding on one of the flowering shrubs. The butterfly was sporadic below 2500 metres, becoming gradually more numerous lower down and very common below 2300 metres in the *Quercus* forest (Fagaceae). The species often swarms in North Africa in June when, in parts of the High Atlas and Middle Atlas mountains, dozens of individuals occur on almost every patch of thistles. It does not usually hilltop and on this occasion there did not appear to be any advantage to the species to do so.

Lycaena phlaeas Linnaeus, 1761
Three males and one female; the species often hilltops; it was quite common on the lower slopes.

Lampides boeticus Linnaeus, 1767
Seven males and one female; the butterfly is a regular hilltopper, flying at breakneck speed around isolated peaks. Seen in small numbers on the lower slopes.

Syntarucus pirithous Linnaeus, 1767
One male positively identified, although some males tentatively identified as the previous species may have been *S. pirithous*; like *boeticus,* it frequently hilltops and is common at lower levels.

Aricia agestis Denis & Schiffermüller, 1775
Two males feeding at flowers; not usually a hilltopping species.

Polyommatus icarus Rottemburg, 1775
Four males and one female; the female was seen to be pursued half-heartedly by one of the males for a short time but otherwise remained unmolested.

Nymphalidae:

Nymphalis polychloros Linnaeus, 1758
Three individuals (sex not determined) sailed slowly over the summit

without lingering. This is quite usual behaviour and the species cannot be said to hilltop. It was just emerging in the *Quercus* scrub at 2000 metres.

Cynthia cardui Linnaeus, 1758
Approximately ten seen (sex not determined); the butterfly was common on the lower slopes. The species is a regular hilltopper and is often the only species to be found in cold weather on isolated barren hilltops.

Polygonia c-album Linnaeus, 1758
One (sex not determined); it is not renowned for hilltopping behaviour, even though in North Africa it is found only locally and in small numbers and would therefore surely benefit from doing so. None were seen lower down.

Pandoriana pandora Denis & Schiffermüller. 1775
Five males were seen flying actively on the ridge and around the summit. This species hilltops only sporadically and is usually found only singly on a summit when it occurs; it was quite common on the lower slopes where both sexes were found in approximately equal numbers.

Fabriciana auresiana Fruhstorfer, 1908
One male flying around the summit in company with *P. pandora*; the author cannot recall seeing this butterfly previously on a summit.

Issoria lathonia Linnaeus, 1758
Approximately 30-40 individuals, predominantly males but at least five females seen in flight, each of which had a stream of three to six males following. The species was very common, and was behaving in a similar manner lower on the slopes; the ratio of females to males was considerably higher lower down,

Melitaea cinxia Linnaeus, 1758
Two males and two females were seen and, like most other species seen that day, females remained unharrassed by the males. Males often hilltop; 1994 was an early season and the species was almost over; it was found in small numbers in very poor condition at 2000-2100 metres.

Melitaea didyma Esper, 1779
One male observed;none were seen lower down; the species rarely hilltops.

Satyridae:

Melanargia ines Hoffmannsegg, 1804
An inveterate hilltopper throughout north-west Africa, ca. eight to ten males were seen on the summit and ridge; only a solitary female was seen lower on the slopes.

Hipparchia aristaeus Bonelli, 1826
Three males; the species was only just emerging and only a further three males were seen lower down. It commonly hilltops.

Pseudochazara atlantis Austaut, 1905
This butterfly hilltops very frequently and in most areas where it is found,

the top of each hill supports a small number of males which defend their territories vigorously. However, on this occasion only a solitary female was seen on the summit ridge (probably one of the first females to emerge), with several males occupying a bare, rocky area immediately below.

Berberia lambessanus Staudinger, 1901

During the four hours or so that these observations were made, eleven males (or possibly a lower number with some individuals appearing more than once) came to the summit from the direction of a large stand of *Stipa* grass (Gramineae) ca. 200 metres lower. Each patrolled the summit and a part of the ridge for up to 15 minutes, flying leisurely about one to four feet above the ground in the manner of males patrolling their more usual habitat in search of females. At one point, a female flew up to the summit from the *Stipa* below (it was seen approaching whilst still some distance away although not identified as a female until it was on the summit) and settled directly on a rock in (presumably) plain view of the two males patrolling at the time; she stayed there immobile for almost five minutes and was completely ignored by the males, before returning whence she came. The species is not noted for hilltopping behaviour; males were quite common on the upper slopes and amongst the *Stipa* slightly lower down; only two females were seen, probably because of their more secretive habits.

Hyponephele maroccana Blachier, 1908

Three males on the summit; a further two males lower down. The butterfly was just emerging and no females were seen.

Coenonympha vaucheri Blachier, 1905

Approximately 20-30 males; no females were noted. The butterfly is a familiar and persistent hilltopper throughout its range in the mountains of Morocco; on this occasion the behaviour appeared to give no advantage to the species since both sexes were common and widespread from 2000 metres to the summit. Indeed, those males which chose to remain on the top would appear to have been at a disadvantage in the sexual stakes.

Pararge aegeria Linnaeus, 1758

Three males seen; it was quite common at 2150 metres and occasional on the higher slopes.

Lasiommata megera Linnaeus, 1767

Another inveterate hilltopper, four males were observed; small numbers of males and two females were seen lower on the slopes. The species is found on most peaks and ridges in suitable habitats throughout the Maghreb.

Lasiommata meadewaldoi Rothschild, 1917

One male was seen on the summit, another male was found at 2500 metres; two females were seen at 2200 and 2500 metres. Like other *Lasiommata* species in North Africa, *meadewaldoi* is a familiar hilltopper and, since its population density is generally quite low, the behaviour is probably of considerable value to the species.

Species flying locally but not on the summit

The following species were also flying that day, lower on the slopes. None usually display hilltopping behaviour.

Pieridae:

Pieris segonzaci Le Cerf, 1923
Flying in small numbers from 1900 to 2150 metres; it often flies at 2800 metres or more and has been observed by the author above 3000 metres on the Toubkal Massif to the north of the Tizi-n-Test.

Colotis evagore Klug, 1829
Three seen at ca. 2150 metres; it is generally more frequent at lower altitudes.

Lycaenidae:

Plebicula atlantica Elwes, 1905
Quite common in a dry, rocky ravine where the hostplant was common, from 1950 to 2100 metres. Although some individuals may be found wandering some distance from its usual haunts, most remain in the vicinity of its hostplant, *Anthyllis vulneraria* (Leguminosae) (Tennent, pers. obs.).

Lysandra punctifera Oberthür 1876
A few individuals of this common and widespread species were seen between 1900 and 2300 metres; it flies in other localities up to 2700 metres.

Other species which may be found on summits in north-west Africa

Hesperiidae:

Hesperia comma Linnaeus, 1758
This is the only Hesperiid in the region which regularly hilltops.

Papilionidae:

Papilio saharae Oberthür, 1879
Like *P. machaon, P. saharae* persistently hilltops in suitable localities throughout Morocco, Algeria and Tunisia. On isolated hilltops and ridges there may be several individuals which fiercely defend their territories; in many places adults are rarely seen other than on high points.

Iphiclides podalirius Duponchel, 1832
Another frequent hilltopper.

Pieridae:

Euchloe tagis Hübner, 1804
None of the three North African races of this butterfly usually hilltop although a number of very worn males of *E. tagis reisseri* Back & Reissinger, 1989, were observed by the author flying very swiftly around the summits of Djebel Lakraa in the west Rif mountains of Morocco in July

1993. The true biotope of the butterfly is considerably lower; it usually flies in April/May and has a rather weak flight. The species has been observed hilltopping in France in small numbers (Gurney 1907: 196).

Euchloe falloui Allard, 1867
Like most *Euchloe* species in the region, *falloui* is a constant hilltopper wherever it occurs.

Euchloe belemia Esper 1792
A common hilltopper, often flying together with *E. ausonia, E. falloui* and *P. daplidice*.

Lycaenidae:

Callophrys rubi Linnaeus, 1758
Occasionally found on peaks and ridges, but probably not a true hilltopper.

Tomares mauretanicus Lucas, 1849
Not usually considered a hilltopper, solitary males have occasionally been found on isolated summits in the Moroccan Anti-Atlas mountains.

Heodes alciphron Rottemburg, 1775
Males of this local species are often found hilltopping, sometimes in quite larger numbers.

Pseudophilotes abencerragus Pierret, 1837
Occasionally observed on summits but probably not a true hilltopper.

Nymphalidae:

Charaxes jasius Linnaeus, 1766
Commonly found hilltopping in Morocco, Algeria and Tunisia, usually only in the morning (Tennent 1993:259); males are fiercely territorial and return time after time to the same favoured rock or low bush on a ridge or summit. It is interesting that Shields (1967:150;154) reported other large Nymphalid butterflies, *C. cardui* and *V. atalanta,* only hilltopping in the afternoon.

Vanessa atalanta Linnaeus 1758
Very occasionally found hilltopping; not a common species in North Africa.

Satyridae:

Melanargia occitanica Esper, 1793
A habitual hilltopper, often flying in company with *M. ines*.

Neohipparchia statilinus Hufnagel, 1766
Occasionally observed hilltopping.

Neohipparchia hansii Austaut, 1879
In suitable localities, a few male *hansii* may be found on most high points and ridges.

Coenonympha fettigii Oberthür, 1874
Sometimes found hilltopping in some numbers, though never as frequently as *C. vaucheri*. The other *Coenonympha* species found in north-west Africa, *C. pamphilus, C. austauti* and *C. arcanioides,* have not been noted doing so.

Lasiommata maera Linnaeus, 1758
This species and *L. meadewaldoi* are very local and uncommon in North Africa and males of both invariably hilltop in areas where they occur, including on rugged, rocky peaks and vertical rock slabs.

Additional comments

Summit populations are comprised primarily of male butterflies; the apparent scarcity of females may be due to the fact that pairs *in copula* are usually inconspicuous or that females only stay long enough to mate, or leave the summit with the successful male to complete the mating procedure lower down. Shields (1967:153) found evidence that rarer species of butterflies are more likely to hilltop than abundant species and the author's observations support this view. Indeed, the proposition may be expanded to include the probability that common and widespread species are more likely to hilltop in those parts of the range (ie in dry, arid areas with sparse vegetation) where population density is lower than elsewhere and may rarely or never hilltop in parts of the range where, presumably, a mate is easier to find using other methods.

Having said that, there are instances where the circumstances of such behaviour do not fit the "searching for a mate" theory well and apparently serve no obviously useful purpose. Indeed, in the majority of cases where females were observed on Adrar-n-Guinnous, they were not subjected to harassment from the larger number of males present. Is this some kind of relict behaviour? Or is the urge to find a hilltop strong even when local circumstances make it an exercise without apparent value? In this case did the volume of individuals and diversity of species present in such a limited area override normal behaviour (certainly it would have been difficult, if not impossible, to establish and defend a territory in the mêlée)? It may be that in species where males emerge before females, for example *P. atlantis,* the first females are guaranteed a mate at the nearest hilltop, although this behaviour might be considerably less important later, when both sexes are emerging in larger numbers.

An introduction to ravining

In carrying out more than 23 months of field work in North Africa between 1991 and 1994, the author became aware of a quite different, but possibly parallel, phenomenon to hilltopping. In semi-desert areas, a number of species were routinely found in dry river beds (wadis) and ravines, under circumstances which suggested behaviour primarily designed to ensure finding a mate.

Some butterfly species may defend territories in wadis in areas where they also patrol adjacent slopes in a search for females. For example populations of *Melitaea deserticola* Oberthür, 1876, a primarily eremic species, occupy geographically well-delineated habitats which might incorporate a number of wadis. Adults fly on dry slopes where the hostplant grows and within this area, males may patrol sections of a wadi which they defend territorially. Both sexes of other, more widespread species, for example *Glaucopsyche melanops* Boisduval, 1828, and *Spialia sertorius* Hoffmannsegg, 1804, may be found commonly in dry wadis and bare slopes in the southern part of their range, but occupy woodland, rough open places and flowery slopes further north.

However two species (one confined to the Anti-Atlas mountains of Morocco, the other a widespread and common butterfly) were seen to occupy dry wadis under circumstances which strongly suggest a parallel phenomenon to hilltopping.

Spialia doris Walker, 1870 (Hesperiidae)

This species flies in very hot and dry places and, in the Maghreb, is apparently confined to the Moroccan Anti-Atlas mountains. The author has seen several hundred individuals but on only four or five occasions has he seen butterflies other than in a dry wadi. To be fair, adults are inconspicuous, fly very swiftly close to the ground and may therefore be overlooked; but it is certain that, in the same way that one can almost guarantee to find the males of certain hilltopping species by climbing to the summit of a suitable hill, so, with a practiced eye, finding *S. doris* can almost be guaranteed in a suitable wadi.

Each male defends a section of river bed the length of which is directly related to the density of the local population. Often, there is no vegetation extant in the wadi and males perch on stones, from which they dart off to investigate any passing insect; each male has one or more favoured spots within the territory. Other males apparently have no territory of their own, but fly along the wadi disturbing each resident male in turn as they do so.

The author has come across female *S. doris* infrequently, but on two occasions observed a female enter a wadi from an adjacent area. On 5th March 1994, in a deep gully below the Tizi-n-Tinififft south of Ouarzazate, a female was seen to fly from above the lip of a walled section and land on a flat rock slab; the resident male was immediately alerted and pounced on the female, a short mating "dance" ensued and the pair flew off. The second occasion was on the edge of a wadi west of Agdz on 26th March 1994 when, very early in the morning, a female, disturbed when it was almost stepped on, flew the ten metres or so to the wadi. A male, which had been resting close to where she came to rest, immediately flew to her side and they sat head to head with wings quivering, for almost a minute. They then remained together motionless for several minutes, probably because the air temperature had not yet risen sufficiently for butterflies to be active.

Although the spiny *Convolvulus* sp. (Convolvulaceae) hostplant grows in profusion at the edge of some wadis or on an adjacent hillside, other river beds are several hundred metres from the nearest hostplant. Other than a device for finding a mate, there seems to be no obvious explantion for this behaviour.

Melitaea phoebe Denis & Schiffermüller, 1775

M. phoebe is a different story. It is a widespread and sometimes common butterfly found in a wide variety of habitats throughout the region. In very dry and barren places, like the Anti-Atlas mountains or the Tizi-n-Taghzeft in the Moroccan High Atlas, females are seldom seen and males are almost never seen away from dry river beds; in the Anti-Atlas it often flies together with *S. doris* (and *S. sertorius*). Although instances of mating behaviour like those described under *S. doris* have not been observed, it is probable that the behaviour of *M. phoebe* serves the same purpose under these conditions.

This phenomenon does not seem to have been remarked upon previously. Shields (1967:151) said ". . . other methods for bringing the sexes together for mating besides hilltopping probably includes . . . in canyons, stream courses, and gullies . . ." and T.B. Larsen (pers. comm.) observed similar behaviour in the Lebanon in addition to noting that *Lycaena asabinus* Herrich-Schäffer, 1851, is ". . . usually found in gorges and dried-out water courses . . ." in the Lebanon (Larsen, 1974:157). Other than these brief references, the author has not seen any record of the phenomenon.

References

Gurney, G.H., 1907. Notes on the butterflies of Digne. *Entomologist,* **40**: 194-196.

Larsen, T.B., 1974. *Butterflies of Lebanon.* National Council of Scientific Research (CNSR), Beirut, Lebanon.

Shields, O., 1967. Hilltopping. *J. Res. Lepid.* **6**: 69-178.

Tennent, W.J., 1993. Selected notes on some Algerian and Moroccan butterflies in 1992 including *Coenonympha austauti* Oberthür, 1881, new to Morocco, *Entomologist's Gaz.* **44**:257-262.

When a small white equals a large, or American confusion

Some years ago I noticed that in the Zoology Museum of Cambridge University, in the teaching collection, there was an example of the Large Cabbage White butterfly (*Pieris brassicae*) labelled "Small White, *Pieris rapae*." This specimen was embedded in plastic and had been supplied by an American Biological Supply House.

Recently, searching the literature for some information, I noticed that in two American books, although the text describes and calls them "Cabbage White, *Artogeia* (Sedenko) or *Pieris* (Simon & Schuster) *rapae*", (the two books differing on the generic name and we even have *Pierus* in one of the indices!) the illustrations are quite clearly that of our Large White, *Pieris brassicae*.